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Comment on “Designing high efficiency segmented thermoelectric generators” [Energy Convers. Manage. 2013;66:165–172] by Hadjistassou et al.



In a recent article [1], Hadjistassou et al. propose an optimized design for a segmented thermoelectric generator (TEG) made of Bi_2Te_3 and PbTe . In order to evaluate the performances of the TEG, they mainly focus on its efficiency. Nevertheless, the definition of the efficiency used by the authors, given by Eq. (8) of Ref. [1], seems to be erroneous. The efficiency is indeed defined there as the ratio between “the thermal power under load (P_L) and no load (P_H) conditions” whereas its genuine definition in the generator regime is the ratio between the electrical power provided to the load and the incoming thermal flux from the hot reservoir. It is important to note that these two definitions are not compatible. Moreover, a typo must have occurred in the sentence introducing Eq. (8): According to Eq. (7) of Ref. [1], one may notice that the thermal power supplied by the heat source when there is no electrical load, i.e., $I = 0$, is P_L . Thus, it seems that the notations P_L and P_H should be swapped in the text.

The use of the wrong definition for the efficiency leads to obtain a maximum value ($\eta = 1$ as demonstrated in Fig. (6) of Ref. [1]) for

$P_L = P_H$, i.e., $I = 0$. This situation is rather surprising as in this case the efficiency should vanish since output electrical power vanishes while there is still a finite thermal power supplied from the heat reservoir (thermal losses associated to thermal conduction). This maximum value is also in contradiction with the Carnot limitation of the efficiency.

In conclusion, the results obtained by Hadjistassou et al. should be considered with caution as the efficiency, the main optimization target used by these authors, is ill-defined in Ref. [1].

Reference

- [1] Hadjistassou C, Kyriakides E, Georgiou J. Designing high efficiency segmented thermoelectric generators. *Energy Convers Manage* 2013;66:165–72. URL <<http://www.sciencedirect.com/science/article/pii/S0196890412003822>>.

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